Mission Science Report
FIREX-AQ Science Flight 4
20190730
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Objective: Aged smoke from the Tucker Fire (targeted on the flight of 20190729) was predicted by trajectory analysis to have been advected North East past Boise. A non-legrangian sampling of this plume would allow aging over ~24 hours to be characterized. After a flight leg over Cascade Reservoir, to enable a MASTER calibration, the flight plan called for a high-altitude lidar run to the North. This run allowed HSRL to confirm the altitude of the layer (in cloud free air) and, serendipitously, overfly a small fire plume (unknown fire). The DC8 then proceed along planed waypoints whiel decending to and maintaining this altitude (13.5 kft MSL). At some point on a leg to the South West, the DC8 emerged from the layer. In an attempt to reenter the pollution, we vectored due West. Air control restrictions kept the DC8 on a westerly track that moved us away from the the pollution traveling from the Tucker fire to the North East. On the previous flight to Tucker, it was clear that there was some influence of the Milepost 97 fire in the area. This could contribute to the pollution seen in the aged plume.

At this point the focus of the mission shifted to assessing the state of the Tucker fire, and performing smoke sampliung of the younger plume. However, the fire was exhausted, and no smoke was visible from the plane during a remote sensing run over the burn scar to allow FRP measurement with MASTER.

The mission focus shifted to the Lefthand Fire in Washington, which had begun smoking around 20:00 UTC of the flight day. A standard down/up lidar/MASTER run and overpass of the burn scar provided a range of altitudes for the smoke, which was traveling East from the fire and acrros the Columbia river. On the Wast side of the river, the plume was contained between ~5 - 8kft, and detached from the surface. East of the river, the plum appeared to be nearly uniformly mixed to the surface. Air control restrictions would not let us below 15kft west of the river, so in situ sampling began at 8 kft decending to 6 kf east of the river. First a double race track was flown to assess uniformity of the measurements (one repeat at the same altitude and distance from the fire as a previous transect). This was followed by downwind transects to the full extent that the plume was very clearly distinct from background air. On the Southern side of the plume, a different pollution source made for a lower contrast boundary between the smoke and background air. It will be interesting to see if we can discern chenmical impacts from the different background air mixing in at either side of the plume. The plume also did not exhibit a strong signal of dilution with incereasing distance downwind (in light and variable winds). We were able to sample to the most-aged end of the plume, likely smoke that had aged over ~8 hours.

With too little fuel to continue sampling, we headed back to Boise at 13kft in the hope of re-intercepting aged Tucker smoke. Indeed, some enhancements were observed, but at present no trajectory analysis has been done to test attribution to Tucker.